

#### +NR (Natural Rubber)

- Rubber Macromolecular Substance made out of resin extracted from rubber tree, *Hevea brasiliensis*, having a chemical structure of polyisoprene.
- Well balanced representative rubber with high elasticity, which retains great strength and stretch properties of pure rubber.
- Due to the elasticity and stretch, used for the rubber band, rubber ball, thread rubber, rubber balloon, seismic isolation rubber and medical rubber, etc.
- Needs compound design appropriate for the application due to the weakness to UV, ozone, heat and oil, etc.

#### +SBR (Styrene Butadiene Rubber)

- Common compound rubber capturing app.80% of synthetic rubber production.
- Random copolymer of styrene and butadiene.
- Prepared from emulsified and solvent polymerization method.
- Used for tread, bicycle tier and general industrial parts.
- Needs compound design appropriate for the application due to the weakness to UV, ozone, heat and oil, etc.

#### NBR (Nitrile Butadiene Rubber)

- A typical oil resistant rubber formed by emulsion co-polymerization of acrylonitrile and butadiene.
- The more acrylonitrile contained in the rubber, the higher mechanical strengths and resistance to oil, abrasion, chemical and heat-aging, but the lower cold characteristics such as elongation, impact resilience and cold resistance.
- Used for oil-proof gaskets, a variety of oil-proof industrial parts, oil-proof gloves and food aprons, etc.

#### Q (Silicon Rubber)

- Special heat resistant synthetic rubber with a unique binding mode in backbone (main chain) consisting of silicon and oxygen.
- Vulcanization methods, strength properties, degree of resistance to coldness, resistance to oil and solvents, as well as the heat resistant properties vary due to the difference in the chemical structure of the side chain.
- Excellent resistance to heat, coldness, non-adhesiveness, but mechanical strengths are generally lower compared to other rubbers.  
Superior resistance to weather and ozone, and excellent electrical insulation

characteristics. Non-adhesive rubber with low toxicity.

- Used for gaskets and conveyor belts in food processing and used as insulation material for precision electrical instruments and used for automotive parts.  
Also, as rubberized cloth, used for the heat resistant bellows for exhaust gas ducts, cold resistant partition curtains, and anti-icing sheets.
- Expensive rubber compared to general and semi-general purpose specialty synthetic rubbers.

#### SEP (Silicon Modified EPDM <Ethylene Propylene Diene Methylene> Rubber)

- Modified EPDM with silicon rubber to enhance resistance to heat, weather and coldness. Retains properties intermediate between silicon rubber and EPDM rubber and retains also excellent resistance to heat and coldness.
- \* SEP is the trademark of Shin-Etsu Chemical Co., Ltd.

#### CSM (Chlorosulfonated Polyethylene Rubber: Hypalon)

- Because of no double bond in the backbone (main chain), the resistance to weather and ozone is stronger compared to EPDM rubber. The colored also retains rubber flexibility and strength even after 10 years of exposure outdoors. Therefore, vivid color combination is possible and no discoloration is likely to occur at all.
- Has excellent resistance to abrasion, chemical, heat, oil and flame. Retains great durability under severe outdoor conditions with well-balanced properties.
- Due to the special performance rubber, not suitable for the heat-seal process and welding process like soft PVC, but never gets stiff under the cold.
- Used for the ceiling materials of large domes, cover for the dish antenna, color roofing materials, fence cover for the athletic field, inflatable boats, oil fence outer cover material, heat resistant firefighter suits, emergency protective cowls, emergency pack, and, protective tape applied on external surface of oil pipeline pipes to protect them from UV, ozone, oil, sand and salt water.

#### CR (Chloroprene Rubber: Neoprene)

- Semi-general purpose special performance synthetic rubber widely used for industrial applications.
- Well balanced properties with resistance to weather, ozone, heat aging, oil, chemical, and flame, and has strength, compared to NR.
- Difficult to produce vivid colors, it is likely to be used in dark colors.
- Can also be used as CR-based glue offering easy and strong bonding. Useful for

applications that require strong bonding of the glue.

- Can be used for the soft rubber with the cold resistance like NR by setting the grade of CR.
- Used for general industrial parts, bellows for industrial applications, sponge sheet for the wetsuits, etc.

#### + EPDM (Ethylene Propylene Diene)

- Ethylene-propylene-diene terpolymer and vulcanizable EP rubber.
- Excellent resistance to weather and ozone, compared to NR, SBR, CR, NBR rubbers due to the low unsaturation degree of main chain. Great resistance to heat deterioration and coldness as well as to inorganic chemical product and polar solvent. Also retains strong electrical insulating property. But rubber gluing process is difficult and requires special technique for it.
- Used for the heat resistant automotive parts, polar solvent resistant rubber roll, packing, roofing material, water proof sheet for pond, water stop sheet for the industrial waste dumping place or other industrial parts and raw material for the olefinic plastic elastomer
- Possible to color to turn it to color rubber, which has more color stability by selecting the appropriate pigment.
- Contains the smallest amount of polymer rubber among available rubbers in the market.
- Possible to design non phthalate ester and non halogen compound and environmentally friendly.

#### TPU (Thermoplastic Polyurethane)

- Block copolymer of thermoplastic ether type polyurethane.
- High strength rubber among thermoplastic elastomers.  
Due to the thermo-plasticity, thermal fusion and welder bonding process can be easily processed, so is urethane based glue.
- Excellent resistance to abrasion, oil, coldness and ozone.
- Non-phthalate ester material and non-halogen material. Both are environment-friendly.
- Easy to use since there is no specific odor like soft PVC materials.
- Excellent hydrolysis resistance because of ether based polyurethane.

#### TFE-P (Fluoro Elastomer)

- Using alternate copolymer of tetrafluoroethylene and propylene.
- Excellent resistance to heat, oil, chemical, flame and weather and excellent electrical insulation properties. Continuous service temperature is set from -10 deg. C to 250 deg.C. Thermal decomposition starts only at temperatures exceeding 400 deg.C, much higher than continuous service temperature. Continuous service temperatures may be changed depending on service conditions.

Excellent chemical resistance to high temperature and high concentration acids and alkali, which cannot be achieved by vinylidene fluoride fluoro-rubber.

- For the cold resistance, rubber elasticity is lost at near  $\pm 0$  deg. C. However, as the brittle temperature is -40 deg. C, this can be used for certain applications depending on their requirements.
- Easy to absorb ketone-esters solvent to cause swelling.
- Used for heat resistant bellows for exhaust gas duct, chemical resistant protective clothes, chemical resistant water tank, protective covering, etc.